

Serial No. 08/915,658

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metal silicide, a second refractory metal silicide and an intermetallic compound separating said first refractory metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide, wherein said intermetallic compound contains no non-metallic materials.

41. (New) A local interconnect comprising:

a composite structure comprising a first metal silicide, a second metal silicide and an intermetallic compound formed by a reaction between said first metal silicide and said second metal silicide, wherein said intermetallic compound comprises metal from said first metal silicide and metal from said second metal silicide, wherein said intermetallic compound contains no non-metallic materials.

#### Remarks

Claims 31-40 have been rejected. Claim 41 has been added, therefore, claims 31-41 are pending in the application.

#### Rejections under 35 USC §102 (b)

Claims 31-34 have been rejected under 35 USC §102 (b) as being anticipated by Okamoto (U.S. Patent No. 4,910,578). Okamoto teaches a  $\text{TiSi}_2$  film 4, a  $\text{MoSi}_2$  film 8, a ternary silicide film 30 formed from a metallurgical reaction between the  $\text{TiSi}_2$  film 4 and the  $\text{MoSi}_2$  film 8. A  $\text{TiN}$  film 10 is formed on the entire surface of the  $\text{MoSi}_2$  film 8. See Figs. 3H and 4D and col. 6, lines 7-9. An  $\text{AlSi}$  film 11 is formed over the  $\text{TiN}$  film 10. See Figs. 3I and col. 6, lines 10-11. The  $\text{TiN}$  film 10 is provided on the  $\text{MoSi}_2$  film 8 to serve as a barrier for Al diffusion, thereby preventing thermal reaction between the  $\text{MoSi}_2$  film 8 and the  $\text{AlSi}$  film 11. See col. 6, lines 21-26.

Claim 31, as amended recites "an intermetallic compound separating said first metal silicide from said second metal silicide, wherein said intermetallic compound comprises metal from said first metal silicide and metal from said second metal silicide."

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At col. 6, lines 64-66, as pointed out by the Examiner, the TiN film 10 may be replaced by a TiW film. According to the definition of "intermetallic compound" provided by the Board of Appeals and Interferences<sup>1</sup>, TiW would constitute an intermetallic compound. As amended, claim 31 recites that the intermetallic compound separates the first metal silicide from the second metal silicide. Claim 31, as amended, also states that the intermetallic compound comprises a metal from the first metal silicide and a metal from the second metal silicide.

The TiN film 10 in Okamoto separates the MoSi<sub>2</sub> film 8 from the AlSi film 11. While film 8 and film 11 are metal silicides, the TiN film 10 does not comprise metal from both films 8 and 11. At col. 6, lines 64-66, Okamoto states that the TiN film 10 may be replaced by a TiW film or a TaN film, however, there is no mention of film 10 containing Al. Thus, every element or limitation of claim 31 is not taught by the Okamoto. Therefore, claim 31 is novel over Okamoto. Claims 32-34 ultimately depend from claim 31, therefore, claims 32-34 are novel over Okamoto.

#### **Rejections under §103 (a)**

Claims 35 to 40 have been rejected under 35 USC §103 (a) as being unpatentable over Okamoto in view of Shepard (U.S. Patent No. 5,227,333). Claim 35 has been amended to recite "an intermetallic compound separating said first refractory metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide." As explained above, this limitation is not taught by Okamoto as the TiN film 10 separates the MoSi<sub>2</sub> film 8 and the AlSi film 11. Okamoto does not teach that the TiN film 10 can contain Al. Furthermore, this limitation is not even suggested by Okamoto as the reference teachings explain the different possible metals that can be used for film 10 "to attain a similar effect" are TiW or TaN. See col. 6, lines 64-66.

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<sup>1</sup> The Board of Appeals and Interferences defined intermetallic compound to mean "composed of two or more metals or of a metal and a nonmetal." See Decision page 5.

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Shepard does not cure this deficiency as Shepard teaches a process for making local interconnect devices having a blanket layer of germanium deposited over the substrate with no mention of an intermetallic compound as claimed. Thus, claim 35, as amended, is nonobvious over Okamoto in view of Shepard. Claim 36 depends from claim 35, therefore, claim 36 is nonobvious over Okamoto in view of Shepard.

Claim 37, as amended, recites "an intermetallic compound separating said first refractory metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide." As shown above, this limitation is not taught or suggested by Okamoto or Shepard. Thus, claim 37 is nonobvious over Okamoto in view of Shepard.

Claim 38, as amended, recites "an intermetallic compound separating said first refractory metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide." As shown above, this limitation is not taught or suggested by Okamoto or Shepard. Thus, claim 38 is nonobvious over Okamoto in view of Shepard.

**New claim 41**

New claim 41 recites "an intermetallic compound formed by a reaction between said first metal silicide and said second metal silicide, wherein said intermetallic compound comprises metal from said first metal silicide and metal from said second metal silicide, wherein said intermetallic compound contains no non-metallic materials." Okamoto teaches two intermetallic compounds. One of the intermetallic compounds, the  $Ti_xMo_ySi_z$  film 30, is formed from a reaction between two metal silicides. This intermetallic compound contains non-metallic materials. The other intermetallic compound, the TiN film 10 which can be TiW, contains no non-metallic materials, but is not formed by a reaction between two metal silicides. Okamoto actually teaches away

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from forming this intermetallic compound by a reaction between two metal silicides as the TiN film 10 serves as a barrier layer to prevent diffusion between the MoSi<sub>2</sub> film 8 and the AlSi film 11. Also Shepard does not mention the formation of an intermetallic compound. Thus, new claim 41 is patentable over the cited prior art.

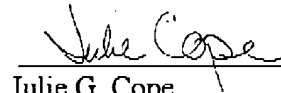
In CONCLUSION

Applicants respectfully submit that, in view of the above remarks, the application is now in condition for allowance. Early notification of allowable subject matter is respectfully solicited.

Respectfully submitted,

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Appendix

31. (Amended) A local interconnect comprising:

a composite structure comprising a first metal silicide, a second metal silicide and an intermetallic compound separating said first metal silicide from said second metal silicide, wherein said intermetallic compound comprises [comprising] metal from said first metal silicide and metal from said second metal silicide, wherein said intermetallic compound contains no non-metallic materials.

35. (Amended) A local interconnect for connecting a first active semiconductor region to a second active semiconductor region on a substrate assembly, said first and second active semiconductor regions being separated by an insulating region, said local interconnect comprising:

a composite structure comprising a first refractory metal silicide, a second refractory metal silicide and an intermetallic compound separating said first refractory metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises [comprising] refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide, said refractory metal from said first refractory metal silicide being different from said refractory metal from said second refractory metal silicide, wherein said intermetallic compound contains no non-metallic materials.

37. (Amended) A semiconductor device comprising:

a substrate assembly having at least one semiconductor layer;  
at least one field effect transistor formed in said at least one semiconductor layer, said least one field effect transistor having a source, a drain and a gate; and  
a local interconnect for connecting at least one of said source, said drain and said gate to another active area within said substrate assembly, said local interconnect comprising a composite structure comprising a first refractory metal silicide, a second refractory metal silicide and an intermetallic compound separating said first refractory

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metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises [comprising] refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide, wherein said intermetallic compound contains no non-metallic materials.

38. (Amended) A memory array comprising:

a plurality of memory cells arranged in rows and columns and formed on a substrate assembly having at least one semiconductor layer, each of said plurality of memory cells comprising at least one field effect transistor; and

at least one local interconnect for connecting at least one of a source, a drain and a gate of said at least one field effect transistor in one of said plurality of memory cells to one of an active area within said one memory cell or to one of a source, a drain and a gate of said at least one field effect transistor in another one of said plurality of memory cells, said local interconnect comprising a composite structure comprising a first refractory metal silicide, a second refractory metal silicide and an intermetallic compound separating said first refractory metal silicide from said second refractory metal silicide, wherein said intermetallic compound comprises [comprising] refractory metal from said first refractory metal silicide and refractory metal from said second refractory metal silicide, wherein said intermetallic compound contains no non-metallic materials.

41. (New) A local interconnect comprising:

a composite structure comprising a first metal silicide, a second metal silicide and an intermetallic compound formed by a reaction between said first metal silicide and said second metal silicide, wherein said intermetallic compound comprises metal from said first metal silicide and metal from said second metal silicide, wherein said intermetallic compound contains no non-metallic materials.